

What's the best way to describe a plane crash, a murder or a malocclusion? Hire a Ph.D. cartoonist.

Say it with animation

By Ann Marsh

YOU ARE A PHYSICIAN. You have a patient with an aneurism of the abdominal aorta, the big blood vessel that runs down to the pelvis, bifurcating toward each leg. Until recently treatment meant major surgery to insert a stent. The device could be delivered via catheter if you knew the dimensions of the aneurism, but you know that only by opening the patient up and taking a look.

In 1996 a software developer found himself sitting next to a doctor in a Salt Lake City waiting room. The two got to talking. The engineer worked for Engineering Animation Inc. Soon EAI was at work on the aneurism problem, with its computer-aided animation. A year later the M.D. tried out a new piece of EAI software.

The program starts with data gathered by a high-density CT scan of the patient's abdomen. EAI's software feeds in the scan and creates a three-dimensional color model of the weakened artery and blood flow. The program then recommends the correct stent size. Without opening the patient at all, the surgeon can pick the right-sized stent and deliver it via catheter. The product, which should reduce both cost and patient recovery time, is awaiting FDA approval before medical supply company Guidant distributes it.

Animation has traveled a long way since Walt Disney and others used it to create synthetic characters for motion pictures. But no company makes animation for as many purposes as EAI, which last year hauled in \$50 million in revenues on the consumer animation side and on a separate CAD/CAM business.

If you think EAI is located in Hollywood, however, or even in Silicon Valley, you're wrong. It is headquartered in Ames, Iowa, and 362 of its 479 employees work there among the cornfields. A public company since 1996, EAI gets most of its revenue selling software for computer-

aided design/computer-aided manufacturing. Customers like Ford Motor and Lockheed Martin use EAI products so that engineers in different places can work on car engines or airplane blueprints simultaneously over the Internet in 3-D. EAI sports a market value of \$450 million largely on the strength of this CAD/CAM software.

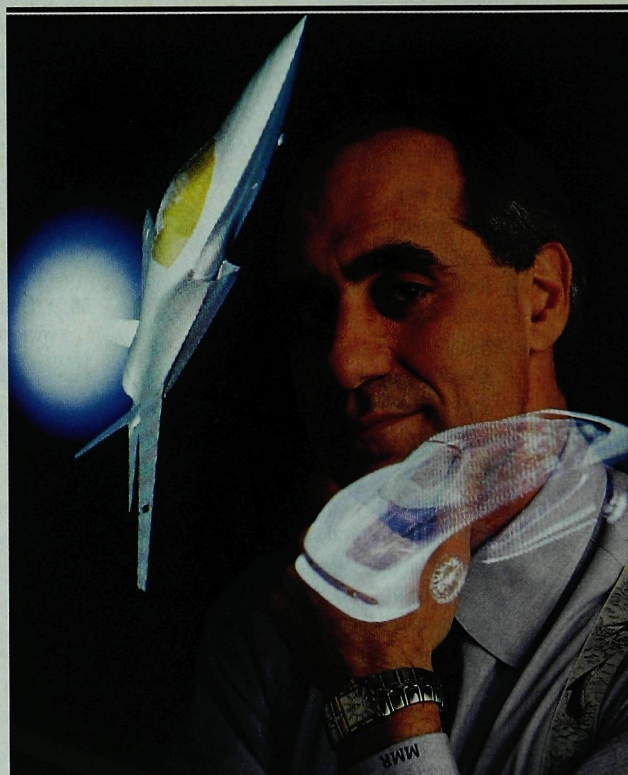
The fun at EAI, though, comes from an animation department with at least 60 projects going on at once.

With technology licensed from nearby Iowa State University, EAI was founded in 1990 to do forensic animation. Its founders were two Iowa State graduate students and two professors. Professor Martin Vanderploeg, now 41, convinced an old college buddy from Michigan State, Matthew Rizai, to come to Iowa and turn some of their ideas about data displays into a viable company.

Rizai, now 41, was ready. A Turkish immigrant, Rizai sold comic books on the street in Istanbul as a kid to make extra money. He came to the U.S., taking an M.B.A. and a Ph.D. in mechanical engineering from the University of Chicago and Michigan State, respectively, and was considering lucrative job offers from Ford Motor Co. and Motorola when Vanderploeg called.

Rizai built EAI slowly, anticipating that computers would grow faster, cheaper and more sophisticated. They did. The animation started to acquire a higher profile. In 1994 EAI animated the Nicole Brown Simpson murder for the ensuing trial. If you are a TV addict, you probably saw EAI's reenactments of the crash of TWA flight 800 and the explosion of the federal building in Oklahoma.

Nowadays improbable customers approach EAI. Two lottery game companies, TeleCom Productions and Scientific Games International, asked EAI to spice up the nightly TV draws. Viewers were bored watching balls drawn out of



EAI chief Matthew Rizai
Cartoons from the cornfields.

EUI REICHMAN

a spinning basket. So EAI animated a horse race. The bell sounds and 12 horses gallop off. The camera follows the horses in a circle. A minute later the race ends with a randomly selected outcome, winners determining the numbers.

It sounds easy, but it required 4,000 minutes of animation to account for all the possible race results. That's a lot of animation. It took Pixar four years to create 81 minutes of animation for *Toy Story*. EAI used custom-made rendering software to get the job done. Lottery commissions in several states have purchased the technology.

EAI keeps on staff a crew of eleven digital medical illustrators, one Ph.D. in molecular biology, a professor of anatomy and other experts to animate everything from biochemical reactions at the cellular level to the dangers of constructing an oil rig.

All these experts enable EAI to tackle diverse products. They work over T-1 lines between 15 offices in places like Salt Lake City, New York and Chicago. Some CAD/CAM experts are based abroad. "Our campus is literally the world," Rizai says. One EAI product will assist dentists. CAD/CAM technology comes in handy here. "For bite analysis, we can show at what point these collisions occur," says EAI Vice President Adrian Sannier. "When we show this to dentists they say, 'It's the view from the tongue!'"

Visit EAI and you can watch breakthrough medical technology in one room and demonstrations of CD-ROM titles for kids in the next. A man wearing a virtual reality mask and gloves manipulates a brightly colored Chevy Lumina engine that seems to emerge from the wall and hang in space. "Maybe you'll shrink yourself to the size of a fuel particle and go through an engine," says James Oliver, EAI's director of product development.

EAI engineers, grown men all, coo over the "Magic Hairstyler Barbie" they completed for Mattel. It was the top-selling kiddie CD-ROM title of the Christmas season. Sannier turns Barbie's lips pink with a lipstick-shaped cursor: "I love when she blots her lips." The CD's art looks childish in plastic pink, but the technology underneath is hard-core. EAI engineers scanned the head of the foot-tall doll to create a computer model from which they guided laser beams into a vat of liquid polymer. The resulting human-size model was used as the basis for the talking Barbie on the CD. Animating her hair—a bugaboo for animators everywhere—took serious programming time.

To illustrate how convincing forensic animation can be, Sannier projects a cartoon car crash onto a big screen. The jury shares the view of the accused, behind the wheel. There's a distraction to the left, a big van pulling off the road, and the camera follows the driver's eye in that direction. Wait! A bike rider glides into view from the right, also watching the truck. "Too late," Sannier says. "You just killed that kid." Actually, the victim was paralyzed and the suit settled. But it's a pretty effective way to make a case.

The Discovery Channel hired EAI to illustrate the dangers of building the Troll Gas Platform in Norway. Taller

Picture this



TWA Flight 800 crash reenactment

Client: National Transportation Safety Board.

Tech hurdle: Getting the animation to correspond exactly to the NTSB crash analysis.

How it works: Uses proprietary algorithms to translate velocity and other physical

movements into the paths and rotations presumably traced by the plane.

Why: Helped people envision plane's final minutes: "Seeing the crash is more compelling than reading about it."

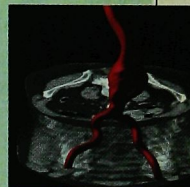
Abdominal Aortic Aneurism software

Client: Medical supply company Guidant

Tech hurdle: Picturing the flow of blood through the twists and turns of the aorta and thrombus.

How it works: Uses 2-D high-density CT scan data to construct a 3-D model of the affected aorta.

Why: Helps doctors choose the right-size stent for insertion via catheter, instead of abdominal surgery.



"Asteroids: Deadly Impact" TV special

Client: *National Geographic*.

Tech hurdle: Capturing the spew of particulate should an asteroid strike Earth.

How it works: Uses proprietary particle system and photo-realistic rendering to hypothesize an asteroid's path.

Why: Illustrates renowned geologist Eugene Shoemaker's theory of an asteroid's impact.

Daily Race lottery game

Client: Lottery game companies TeleCom Productions and Scientific Games International.

Tech hurdle: Generating 4,000 minutes (over 66 hours) of animation.

How it works: Uses proprietary software to animate a one-minute race among 12 horses. Computer picks a random outcome to select the day's lottery numbers.

Why: To generate more excitement in the daily lottery draws.



Oklahoma City bombing reenactment

Client: *Inside Edition*, NBC and other news media.

Tech hurdle: Combining information provided by an explosives expert, a designer of the Alfred P. Murrah building and witnesses to accurately recreate the explosion.

How it works: Used proprietary rendering software to generate frames quickly enough to finish the work in time for news deadlines.

Why: To spice up the evening news.

—A.M.

than the Empire State Building, the rig is anchored 1,000 feet below sea level. Troll's sister rig imploded, killing 167 and causing an earthquake measuring 4.0 on the Richter scale. Filming underwater was perilous, so the Discovery Channel relied on EAI to tell the much of the story.

For a *National Geographic* television special EAI visually theorized what would happen if an asteroid the size of Texas one day struck the Earth. Answer: You don't want to know.

It's all very techie and lots of fun, but make no mistake: This is a commercial operation. Rizai leans on

developers to turn projects, often in days. Result: On average, revenues have better than doubled every year for the past five years. Earnings before nonrecurring charges are up a thousandfold, to \$6.2 million last year.

"This is not an R&D lab," Rizai insists. "We are in business."

Carl Icahn doesn't know much about biotechnology, but he knows a lousy merger when he sees one.

Rx: no merger

By Zina Moukheiber

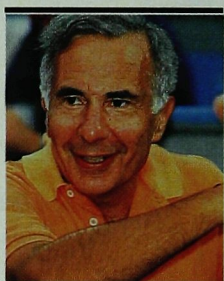
CARL ICAHN attended medical school at New York University, but bolted after two years. "I hated it," he recalls. Life plays funny tricks: Icahn, the well-known corporate raider, is now in the medicine business. He's the largest shareholder in Cadus Pharmaceutical Corp., a six-year-old biotechnology company in Tarrytown, N.Y.

Icahn first came upon Cadus in 1993, and was introduced to one of its founders, James Broach. A biochemist who also teaches molecular biology at Icahn's alma mater, Princeton, Broach was working out of an old shoe factory in New York City's artsy SoHo district. Icahn agreed to put up \$5 million for 28% of Cadus' 12 million shares.

"It [the science] sounded intriguing," says Icahn, who has since spent many hours learning about the subject. Cadus, it so happens, is into functional genomics.

Genomics proper is concerned with identifying genes, the snippets of DNA that encode the recipe for proteins. Functional genomics goes the next step, trying to figure out what those genes and proteins actually do. Scientists can then hope to understand disease and devise treatments.

One of the ways functional genomics works is to use models to identify proteins or small molecules that interact with other proteins. That gives scien-



Raider Carl Icahn
Into genomics.

GERARDO SONOZA/OUTLINE

tists clues as to what the function of the proteins is and whether or not they are indeed in a disease process. Millennium Pharmaceuticals manipulates mammalian cells; Exelixis fiddles with those of the common fruit fly. Cadus' specialty is yeast cells—the same yeast that bakers and brewers use. Indeed, the company's laboratory smells of leavened dough.

Yeast and humans have a lot in common. Their genetic makeup is similar. "Insight into yeast can give us insight into human cells," says Cadus' Broach. Yeast has other advantages in disease research. Its cells are tougher than animal cells because, unlike them, yeast cells live alone, unsupported by blood and bone. Because yeast is so tough, scientists can lob volley after volley of drugs at it, speeding up the drug discovery process. Besides, yeast is relatively cheap.

Cadus is using yeast to identify a class of proteins known as G protein-coupled receptors. These protuberances perch on a cell's membrane and serve as gateways to the outside. There are hundreds of these receptors—the Human Genome Project discovers more of them all the time—and they are known to play a role in a range of illnesses, including inflammatory diseases, arteriosclerosis and arthritis.

Most drugs on the market today target such receptors: SmithKline

Beecham's ulcer medicine Tagamet, and American Home Product's hypertension drug Inderal. The world market for such drugs is huge—over \$85 billion last year.

To get a crack at the receptor gateway market, Cadus is partnering with pharmaceutical companies. It does research for Bristol-Myers Squibb, SmithKline Beecham and Belgian Solvay Pharmaceuticals. They have paid Cadus \$23 million in research fees, and it will receive additional fees from clinical developments and royalties from any drugs that result.

Using Cadus' yeast technology, Bristol-Myers—which owns 17% of Cadus—has developed potential drugs to treat cardiovascular, inflammatory, metabolic and central nervous disorders, obesity and diabetes. All this stuff is still in a preclinical phase. John Keller, head of SmithKline's Alliance and Technology Group, says Cadus has helped it identify several receptors. For fear of tipping the competition, he won't say for which diseases.

Back to Carl Icahn. Cadus' well-respected chief executive, Jeremy Levin, resigned in December. In spite of the promising research Cadus is doing, its stock fell from \$8.50 a share in late December to a recent \$6.60.

Levin had wanted to buy Trega Biosciences, an automated chemistry company, which could have expanded Cadus' drug discovery efforts. Icahn shot down the idea for two reasons, the first of which he now denies: The deal would have diluted his stock by as much as 40%. It would have also accelerated Cadus' cash burn rate, bringing its cash on hand too low, he says. "I've seen too many of these [biotech] companies bite the dust."

Icahn doesn't know a heck of a lot about biotechnology, but he does know how and why companies go broke. He may be just the doctor this company needs.

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